in the region of Luleå. The red light was visible at different places for periods varying from ten to thirty minutes, the light streak of cloud from some minutes to seventy-five, the whole phenomenon being visible from ten to 105 minutes.

At places nearest to the locality of explosion and at some others there was seen only the intensely luminous fire-ball, not the red after-light, probably in part owing to the sky being cloudy, and in part also for the same reason as that which caused the dark central field in the case of the Ställdalen meteor.

The observations reported correspond so closely with the figures calculated on the supposition that the explosion took place *half way between Luleå and Nederkalix at a height of* 35 *kilometres above the surface of the earth*, that this point of the meteor's path may be considered as determined with considerable accuracy.

All observers agree in this, that the red pillar of fire which immediately after the explosion was seen at Upsala, Stockholm, Fredrikshamn, St. Petersburg, &c., had at first the same direction as the meteor's spark-bestrewn path, but that the position of the fire-pillar towards the close of the phenomenon underwent change by its spreading out to a height in the atmosphere which in the north of the Gulf of Bothnia was about three times as great as that of the fire-ball proper.

The tangent of the meteor's path at the place of fall had an inclination to the horizon of about 25°. The radiation point was situated somewhere in the constellation Orion. The meteor appears to have been first seen at a height at which it was beyond the earth's shadow, and illuminated by the sun. At first it had the appearance of a bright star, but afterwards increased rapidly in diameter till its apparent size was equal to that of the sun or moon. From a comparison of numerous observation it appears that the meteor's luminous nucleus had a diameter of 1,000 metres.

The Luleå meteor is interesting for the splendid light-phenomenon visible after its explosion, and particularly for the long time it remained in the atmosphere without much change of place.

This light began immediately before the meteor exploded in the region of Luleå, but it could not have been caused by combustible substances thrown off in consequence of the explosion, as in that case the red light ought to have spread itself from the place of explosion about equally in all directions, and afterwards have sunk down rapidly and gone out. Instead, this light was extended in the direction of the meteor's path, and it remained in the sky for more than an hour. An approximate idea of its size and height in the atmosphere is given by observations at Upsala and Fredrikshamn:—

	Breadth of the red luminous pillar.	Approximate height of the point.
Upsala (2)	6 kilom.	125 kilom.
Fredrikshamn ...	12 ,,	150 ,,

The appearance of this light varied much. At some places it resembled a pillar of equal breadth ("like a beam"), at others it appeared as a red spot, from which a pillar of the same colour descended to the horizon but disappeared sooner; at others, again, luminous rings were observed. After the light itself disappeared, its position in the sky was marked for a long time by numbers of "wool-like" clouds.

Several observers remark that the red fire-pillar in question, during the time that it remained visible in the sky, slowly assumed a more vertical position, and then took the form of a 7 or a reversed S.

The Luleå meteor besides, like most other meteors, left behind it for some moments a white luminous streak of fire in that part of the sky through which it passed. This streak of fire clearly arose from constituent parts of the fireball proper which had been loosened by the resistance of the air, and remained behind.

The red light, on the other hand, appears to have had a different origin. It could not have consisted of small particles left behind in the uppermost strata of the atmosphere, for they would speedily have fallen down. The light rather appears to have originated from new combustible or luminous material which followed the nucleus of the meteor, and for the space of half an hour entered the atmosphere at nearly the same place. The Luleå meteor was thus a true cometoid.

It appears that the attraction of the earth and the retardation caused by the resistance of the air gave the path of the dust, causing the red light, a more parabolic form than that of the meteor's nucleus, for a number of observers state that the red pillar gradually raised itself from the slanting position of the path of the meteor towards the vertical line. The direction of the meteor's train, as in the case of true comets, did not lie quite in the path of the meteor. The foot of the luminous pillar was observed above Avasaxa at a height of about 100 kilometres when the nucleus exploded north of Luleå. After the disappearance of the red light there remained white and woolly clouds, resembling light clouds illuminated by the sun. These may have arisen from parts of the meteor which were directly illuminated by the sun, and thus became visible when the stronger light, caused by direct combustion, ceased. On April 29, in the latitude of Avasaxa, bodies at a greater height from the surface of the earth than 76 kilometres are beyond the shadow of the earth even at midnight.

The meteor's light was at first white, then for a long time of the same shade of red as the dawn, and near the close of the phenomenon again white. The light probably arose from the combustion of carbon and carburetted hydrogen, the products of combustion, steam, carbonic acid, &c., absorbing part of the rays of light, and giving the nucleus a reddish tinge. Towards the close the gaseous envelope was dispersed, and the red colour ceased a long while before the meteor finally disappeared. Search was made for any meteorites or meteoric dust that might have fallen, but none were found, although stones were seen to fall to the ground "like rain" by two Lapp girls near Jockmock, and a Lapp reindeer-herd on the mountain Sarvikobbo saw the "stone-swarm" in question disappear in the forest *below* him.

SCIENTIFIC SERIALS

Annalen der Physik und Chemie, No. 6.—In view of the considerable discrepancy between observation and theory with regard to the propagation of electricity, Herr Lorenz has been led to make fresh experiments (here described). In one method the telephone was used; the other was a modification of Feddersen's jar-discharge method. Herr Lorenz shows that, in the case of iron telegraph lines, the magnetism of the iron must be considered. The electro-dynamic constant of unit length of an overland telegraph wire is expressed by $C = 2 \log. \frac{2h}{a} + 2\pi k$, where h denotes the height above the ground, a the radius of the wire, and k the function of magnetisation. For unmagnetic wires, the latter member falls away. Applying the formula to Fizeau and Gounelle's experiments, and putting the function of magnetisation of the iron wire = 10, we get the velocity 126000 km., while that observed was 101710 km. The difference is much less than by the ordinary reckoning, and may be attributed, the author thinks, to faults of insulation.—Studying the generation of the currents of a Gramme machine with regard to time and resistance, Herr Herwig finds, *inter alia*, that at the commencement a greater manifestation of force is obtained with greater resistances; but in later stages of development of the current, the force increases more for smaller resistances. The slow development of current with great resistances is shown by the fact that with 13·4 Siemens' units, the full force possible was not reached in four seconds.—Prof. Colley concludes from experiment, that the "polarisation of electrodes" in electrolytes is not to be attributed to dielectric polarisation of the latter, but deserves the name just given. It is not denied, however, that the dielectric polarisation may exist, being completely masked by the other.—Herr Settegaast makes some contributions to quantitative spectral analysis; his paper treating (1) of distribution of a base between chromic acid and other acids; (2) of quantitative mode of determination of nitric acid, and (3) of determination of phosphoric acid.—Among the remaining subjects handled, we note the angle of polarisation of fuchsin (Glan), application of the method of dimensions to proof of physical propositions (Neesen), and the heat-conduction of liquids with reference to currents arising from differences of temperature (Oberbeck).

THE *Quarterly Journal of Microscopical Science*, July, contains:—Notes on some of the reticularian rhizopoda of the *Challenger* expedition, by H. B. Brady, F.R.S., with a plate. In this second memoir several new and most interesting forms are described and figured. The author mentions that he has failed to detect in fresh specimens of *Dactylopora eruca*, P. & J., the structures figured by M. Munier-Chalmas, which figures happen to be reproduced in this number of the Journal, as part of the minutes of the Dublin Microscopical Club.—On the morphology of the vertebrate olfactory organ, by A. M. Marshall, M.A., with two plates.—On the brain of *Blatta orientalis*, by E. T. Newton, with two plates.—On the microphytes which have been found in the blood and their relation to disease, by Dr. T. R. Lewis, with

a plate.—Observations on the glandular epithelium and division of nuclei in the skin of the newt, by Dr. Klein, with a plate.—On the early development of the Lacertilia, with observations on the nature and relations of the primitive streak, by F. M. Balfour, M.A., with a plate.—On certain points in the anatomy of *Peripatus capensis*, by F. M. Balfour, M.A.—Notes and Memoranda.—Proceedings of the Dublin Microscopical club from November 21, 1878, to March 20, 1879.

THE *Journal of Anatomy and Physiology, Normal and Pathological*, July, contains:—On supernumerary nipples and mammæ, with an account of 65 instances observed by Dr. J. M. Bruce, with a plate.—On the origin and composition of the bodies found in compound ganglia, by Dr. G. T. Beatson.—On the physiology of the Turkish bath, being an inquiry into the effects of hot dry air upon man, by Dr. W. J. Fleming.—On the form and structure of the teeth of *Mesoplodon layardii* and *M. sowerbyii*, by Prof. Dr. Turner.—On the element of symbolic correlation in expression, by Prof. Dr. Cleland.—On an intra-thoracic lymphoid tumour, by Dr. R. H. Clay.—On inequality in length of the lower limbs, by Dr. J. G. Garson.—On a large subarachnoid cyst involving the greater part of the parietal lobe of the brain, by Dr. D. J. Cunningham.—On the process of healing, by Dr. D. J. Hamilton, with a plate.—On the dentition of *Bettongia penicillatus*, Gray, by George Leslie.—On a new theory of contraction of striated muscle, and demonstration of the composition of the broad dark bands, by Dr. D. Newman, with two plates.—Note of a case of articulation between two ribs, by Dr. J. H. Scott, with a note by Prof. Dr. Turner.—Additional note on the organ of Bojanus, by M. M. Hartog, M.A.—On a two-headed sartorius, by G. S. Brock.—Note on ethidene, by Prof. Dr. M'Kendrick.—Notice of Kölliker's "Developmental History of Men and the Higher Animals," by F. M. Balfour.

Zeitschrift für wissenschaftliche Zoologie, Bd. xxxii. Heft iii., contains:—Studies among the sponges, by Prof. Elias Metschnikoff, of Odessa, containing notes on the development of *Halisarca dujardinii*, on the anatomy of Ascetta, on the history of development in the calcareous sponges, on the inception of nourishment in sponges, and concluding with some general remarks on the group. Four folding plates illustrate this memoir.—On the power possessed by different mammals of holding fast to and moving upwards by means of atmospheric pressure on smooth and more or less perpendicular surfaces, by Dr. O. Mohnike.—Contributions to our knowledge of the organs of generation in the free living copepoda, by Dr. A. Gruber, with five plates.—Researches on the minute structure of the intestinal canal in *Emys europæa*, by Dr. J. Machate, with a plate.—On a new species of infusorian (*Tintinnus semiciliatus*), by Dr. V. Sterki, with figures.—On the final alterations in Meckel's cartilage, by Dr. B. Baumüller, with two plates.

SOCIETIES AND ACADEMIES

PARIS

Academy of Sciences, July 14.—M. Daubrée in the chair.—The following papers were read:—Addition to my memoir on the principle of least action, by M. Serret.—On the direct combination of cyanogen with hydrogen and the metals, by M. Berthelot. Cyanogen and hydrogen, pure and dry, mixed in equal volumes, and sent through a narrow glass tube heated to 500° to 550°, give some sign of combination; but the reaction is more complete when the mixture is heated several hours to the same temperature in a sealed tube of hard glass; this is afterwards opened over mercury. The union of cyanogen with some metals was found also to be merely a question of time and temperature. The substances were heated together in a sealed tube. Silver and mercury did not combine with cyanogen at any temperature. The analogies of cyanogen with the halogen substances are extended in this inquiry, beyond formulæ, to methods of direct synthesis.—On the organo-metallic radicals of tin: stannbutyls and stannamyls, by MM. Cahours and Demarçay.—On an application of the theory of elliptic functions, by M. Picard.—Researches on the effects of the rheostatic machine, by M. Planté. Using a machine of 80 condensers charged by his secondary battery of 800 couples, he obtains noisy sparks more than 0·12 m. long, and if they are produced above an insulating surface sprinkled with flowers of sulphur, they may even attain 0·15 m., and leave a sinuous furrow. When short of their maximum length they often form closed branches like *anastomoses*; also, on the sprinkled surface, *arborescences*, which appear after removing the excess of sulphur by a few light taps. This, M. Planté thinks, may explain the plant-like impressions sometimes found on the bodies of persons struck by lightning. But little dynamic electricity is required for these and other static effects described (that from 3 or 4 Daniell elements). By associating all the condensers in surface, and adding a small special rotating commutator, static effects of *quantity* are had, different from those of *tension*. By mechanical force of successive sparks M. Planté elevates water.—On the treatment by submersion of vines attacked by phylloxera, by M. Faucon. Some of the insects always survive.—On the phylloxera in the Côte d'Or, by M. Viallane.—On the treatment of anthracnose; observations of M. Puel, by M. Portes. The efficacy of lime is demonstrated.—Observations at Marseilles Observatory, by M. Stephan.—On a definite integral, by M. Callandreau.—On the integration of equations with partial derivatives of orders superior to the first, by M. Pellet.—Minimum of dispersion of prisms; achromatism of two lenses of the same substance, by M. Thollon. Two lenses of the same substance, traversed, the one at the minimum of dispersion, the other at the minimum of deviation, by a luminous beam, may at once deflect and achromatise the light. Hence a system of lenses of the same matter may be made, having one focus and at the same time being achromatic.—On the vapour of bisulphydrate of ammonia, by M. Isambert.—On the dissolution of carbonic oxide in acid protochloride of copper, by M. Hammerl. A thermo-chemical investigation.—On the transformation of tartaric acid into glyceric and pyruvic acids, by M. Bouchardat.—On the isomerism of borneol, by M. De Montgolfier.—On bichlorhydrate of turpentine, by the same.—On some derivatives of indigotine, by M. Giraud.—Comparison of effects of inhalations of chloroform and ether, in anæsthetic and in toxical dose, on the heart and the respiration; applications, by M. Arloing. In the first phase attention should be given both to the heart and the respiration, whether chloroform or ether be used; in the second, the heart must be watched, and especially in the case of chloroform; in the third, the respiration. Chloroform should be preferred to ether, where the operation may be long, as the *denouement* of intoxication by ether is more sudden.—Causes of death from intravenous injection of milk and sugar, by MM. Moutard-Martin and Richet. Death from injection of a great quantity of milk is the result of bulbar anæmia, which produces phenomena of excitation.—On the reproduction of Amblystomas at the Museum of Natural History, by M. Vaillant.—Comparative anatomy of the Hirudineæ; organisation of the *Batracobdella latasti*, C. Vig., by M. Vignier.

CONTENTS